VLBI Software Documentation
Scheduling Program

drudg: Experiment Preparation Drudge Work

N. R. Vandenberg
NVI, Inc.

Program Reference Manual

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This document was prepared using WordPerfect. The font size for normal text is 12-point. A smaller font is used for some sample program output so that it will fit on the page in this document. The following typographical and font conventions are used throughout this document.

Times New Roman	Standard font for the text of this manual.
Times italics	Used for single-word emphasis in the text.
Times bold	Used to highlight whole paragraphs to bring them to the reader's attention.
`Courier`	Indicates what the computer types. Program names appear in this font, also prompts, file names, listings of files, and sample output.
`Courier bold`	Indicates what the user types verbatim. Responses to program prompts and sample commands are in this font.
Arial italics	Indicates a variable, context-dependent quantity. The parameters to a command or the format of an output line are in this font.

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1.0 Purpose and General Overview

The program `drudg` does in an automatic fashion all of the tedious tasks required for experiment preparation. `drudg` reads as input a VLBI network schedule file and generates output for an individual station.

`drudg` can read and understand schedule files from the following scheduling programs:

- the NASA `sked` program,
- "drudg file" from the Haystack `PC-SCHED` program,
- the VEX file output from the NRAO `sched` program.

`drudg` can make the following types of output:

- produce full schedule listings for each station,
- write files for the various antenna pointing computers,
- translate schedules into SNAP commands and list them,
- make a summary list of a SNAP schedule,
- create SNAP procedure files,
- print bar code tape labels,
- shift schedules or SNAP files to a new date

The philosophy of `drudg` is that no decisions are made by this program. It is assumed that all of the user's input regarding a VLBI experiment was handled by the scheduling program. It is the task of `drudg` merely to carry out the decisions which are reflected in the schedule file.

`drudg` does extensive checking for complete and consistent information in the schedule file. Some problems may appear to be `drudg` errors but they are really errors in the original schedule file. Users should be aware of this and refer to the **Standard Schedule File Format** manual and the **`sked`'s Catalogs** manual for details on what the schedule file should contain.

`drudg` is available in two versions, one runs under Linux on the Field System PCs and the other runs on the same HP-UX machines as `sked`. Both versions are fully compatible with each other and produce identical output. Both versions are kept up to date together.

`drudg` can be run interactively or in a "batch" mode. In the latter mode, one type of output may be generated by specifying all the input parameters on the command line.

2.0 Installation

2.1 Linux version of drudg

The Linux version of `drudg` is a part of the Field System. The program is automatically installed at the time that you install a new version of the Field System. Please refer to the Field System manuals for further information about Linux and installation of the software. Refer to section 2.4 below for information about the `drudg` control file.

2.2 HP-UX version of sked and drudg

The HP-UX version of `drudg` is normally distributed with `sked`. Instructions for installation and setup of the control file are included in the **`sked`** manual.

2.3 HP-UX version of drudg only

The HP-UX version of `drudg` is also distributed in a standalone version. The distribution files for the standalone version are available via electronic file transfer using the Goddard VLBI group's anonymous ftp server.

Machine	Disk area
`gemini.gsfc.nasa.gov` (use anonymous ftp)	`pub/sked/drudg`

The available files and their contents are:

File name	Contents
`drs.tar.Z`	Compressed source files, include files, and control file
`drudginstall`	Installation script
`readme.`*`date`*	A readme file with brief instructions

The compressed file is automatically uncompressed and un-tar'd by the installation script. To install `drudg`, edit the script and follow the instructions in it.

2.4 Control File

The control file, named `skedf.ctl`, is used for both `sked` and `drudg`. The control file contains paths and names for input, output, scratch, and catalog files as well as printer names, script names, and tape label sizes for `drudg`. The catalog file names are not used by `drudg`. If `drudg` cannot find the control file, then all the information is defaulted except for the label printer type and the label size. For example, all the path names default to the local directory.

A system version of the control file is read first, located in a directory that is compiled into the program. A local, or personal, version of the control file is read second and any items found there override the same items previously found in the system control file. Any items not specified in the local control file will retain the values found in the system control file. On the Field System the system control file is located in `/usr2/control/skedf.ctl`. On HP-UX the location is determined by specifying the path name in the installation script. The local version of the control file, if any, is ready from the local directory.

The control files are read once when `drudg` starts. If you make any changes in either of the control files the changes will take effect the next time you run the program.

When you first install the Field System, the default version of the control file is copied into `/usr2/control/skedf.ctl`. You can edit this file to set up the parameters that you want for your system. If you are installing an upgraded version of the Field System, and if you want to use some of the features of the new control file, you will need to copy the new default version of the control file from `/usr2/fs/st.default/control` into your `/usr2/control` area, or modify your current version.

Before editing the control file, review the comments in the default file and then edit it as appropriate for your needs. A copy of the distributed file is listed below. Refer to the section on Option 9 (page 43) for how you can change some of the printer items interactively. Refer to the descriptions for Options 1 (page 16), 4 (page 31), and 5 (page 32) for more about the meaning of the output control items.

```
* skedf.ctl - sked/drudg program control file
*
* Last modified 970315 by NRV for mira.gsfc.nasa.gov
*
```

```
* The default version for drudg in the Field System is found in
* /usr2/fs/st.default/control/skedf.ctl.
*
* This file is free-field except for section names which must begin
* in column 1 with a $. Either upper or lower case is OK for section
* names. Remember that path and file names in Unix are case-sensitive.
*
$catalogs
*  not used by drudg
*
$schedules
* Enter the path name for schedule (.skd) files. If not specified,
* the default is null, i.e. use the local directory.
* Example:
*/usr2/oper/
*
$snap
* Enter the path name for SNAP (.snp) files. If not specified, the
* default is null, i.e. use the local directory. The old name for this
* section was $drudg, which is still recognized.
* Example:
*/usr2/sched/
*
$proc
* Enter the path name for procedure (.prc) files. If not specified,
* the default is null, i.e. use the local directory.
* Example:
*/usr2/proc/

$scratch
* Enter the path name for temporary files. If not specified, the default
* is null, i.e. use the local directory.
/tmp/
*
$print
* Printer type for listings:
* Enter the printer type for drudg listings. If not specified,
* the default is laser. Recognized names: laser, epson, epson24.
* This can be changed interactively with option 9.
* Examples:
*printer laser
*printer epson
*printer epson24
*
* Printer control for listings:
* Enter any command strings or scripts to be used for printing in
* portrait or landscape. The key words "landscape" and "portrait"
* indicate the orientation.  Following the key word, all characters
```

```
* on the line (including blanks) are read as the command.
* If no commands or scripts are specified, drudg defaults to embedding
* escape sequences for the output desired into the file and uses
* the system command "recode latin1:ibmpc" piped to "lpr" to print
* the temporary file.
* Examples:
* This example is for a laser printer, 6 lines/inch, 10 char/inch:
*portrait lpr -ofp10 -olpi6 $*
* This example is the same as above but for landscape:
*landscape lpr -ofp10 -o1pi6 -olandscape $*
* These examples are the same as above but for a smaller font:
*portrait lpr -ofp16.66 -olpi6 $*
*landscape lpr -ofp16.66 -o1pi6 -olandscape $*
*portrait <script name for portrait output>
*landscape <script name for landscape output>
*
* Output control for listings:
* Enter the desired orientation and font size for listings. Key words
* are option1, option4, and option5 for the three listing options.
* Follow the key word by a 2-letter code, first letter "p" or "l" for
* portrait or landscape, second letter "s" or "l" for small or large
* font. The defaults are as listed below:
*option1 ls (landscape, small font, for full schedule listing)
*option4 ps (portrait, small font, for full SNAP listing)
*option5 ps (portrait, small font, for SNAP summary listing)
*
* Tape label script:
* Enter a script for printing tape labels. If no script is specified,
* the default is to use "lpr" to print the temporary file.
* Examples:
*labels <script name for label printing>
*
* Tape label printer type:
* Enter the name of the label printer. If no name is specified, drudg
* will not attempt to print tape labels. Recognized names are postscript,
* epson, epson24, laser+barcode_cartridge.
* Examples:
*label_printer postscript
*label_printer laser+barcode_cartridge
*label_printer epson
*label_printer epson24
*
* Label size:
* Specify label size parameters, only valid for "postscript" type. No
* default, if no size is specified, drudg cannot print labels. Test
* your parameters on plain paper first!
* <ht> height of a single label, in inches
* <wid> width of a single label, in inches
```

```
* <rows> number of rows of labels on the page
* <cols> number of columns of labels on the page
* <top> offset of the top edge of the first row of labels from the
*      top of the page, in inches
* <left> the offset of the left edge of the first column of labels
*      from the left side of the page, in inches
* Format:
* label_size <ht> <wid> <rows> <cols> <top> <left>
* Examples (not all of these have been tested on actual stock):
*label_size  1.0   2.625  10     3     0.5   0.3125 Avery 5160
*label_size  1.333 4.0     7     2     0.5   0.25   Avery 5162
*label_size  2.0   4.0     5     2     0.5   0.25   Avery 5163
*label_size  1.5   4.0     6     2     0.75  0.25   Avery 5197
*label_size  1.375 2.75    8     3     0.0   0.0    HP 92285L
*label_size  1.5   3.9     7     2     0.0   0.16   Avery L7163
*
*$misc
* Miscellaneous information, in the format <keyword> <value>.
* Enter the epoch for drudg to use on the SOURCE commands in SNAP files.
* Default is 1950 if none is specified. Only 1950 or 2000 are valid.
* Examples:
*epoch 2000
*epoch 1950
```

3.0 User Guide

This section describes the input files, output files, and listings produced by `drudg`.

3.1 drudg Input Files

3.1.1 Schedule Input File

The schedule file should be complete and correct before you run `drudg` if you are going to use all of the `drudg` options. It is possible to run `drudg` with incomplete `$CODES` section or with a missing `$HEAD` section, but some `drudg` options may not do what you desire if these sections are not filled in correctly.

Please refer to the **Standard Schedule File Format** manual for details on the format of the schedule file. Refer to the **sked's Catalogs** manual for further details on the ultimate source of the information in the schedule file.

The naming convention for geodetic schedule files is to use as root the experiment code name as provided in the master schedules distributed by SGP, and to use an extension of `skd`. The general form is

experiment`.skd` Example: `ca036.skd` from NASA `sked`

The naming convention for astronomy schedule files is to use as root the experiment code assigned when the proposal is granted observing time. Examples:

experiment`.drg` Example: `em019.drg` from `PC-SCHED`
experiment`.skd` Example: `gm031.skd` from NRAO `sched`

When you are prompted for an input schedule file, you can type the schedule name without an extension if your file is named according to the above conventions. `drudg` first assumes a `.skd`

extension if you don't type a period in the file name. If it doesn't find a file with `.skd` as the extension it next looks for a file with a `.drg` extension.

To the schedule file name that you type, `drudg` prepends the path, if any, that was specified in the `$schedule` section of the control file (see section 2.4, page 3). For example, if you type a schedule name of `ca036`, and if the path in the control file is `/usr2/oper`, then regardless of the directory from which you run `drudg`, it will look for a schedule file named `/usr2/oper/ca036.skd` or `/usr2/oper/ca036.drg`. You can override the control file path by typing a path name for the schedule file. For example, if you type `/users/nrv/ca036` or `./test/t1`, `drudg` does not prepend the path from the control file.

Within `drudg`, the "schedule name" is the name of the schedule file without extension. The schedule name in the above example would be `ca036`. This is the root used to form the names of all of the files that `drudg` reads or writes.

Within `drudg`, the "experiment name" is the name found on the `$EXPER` line in the schedule file or in the `exper_name` VEX statement. If no experiment name is given in the file, then `drudg` uses `XXX`. The experiment name is printed on the listings, written into output files, and printed on tape labels. Normally the schedule and experiment names are the same.

3.1.2 SNAP Input File

`drudg` can be run without an input schedule file if you already have a SNAP file available. You will be presented with a limited set of options that includes the things you can do with only a SNAP file available: list the SNAP file, list a summary of the SNAP file, print tape labels, or shift the SNAP file. This type of input is not available in non-interactive mode.

The naming convention for SNAP files is

experimentID`.snp` Example: `ca036wf.snp`

where *ID* is the two-character station ID. The schedule name is assumed to be the root of this file name, in this example it is `ca036`. `drudg` looks for the SNAP input file in the directory specified in the `$snap` section of the control file (see section 2.4, page 3). If no directory was given, it looks in the local directory.

`drudg` reads the first comment line of the SNAP file to get the experiment name and the full station name. The line has the following format:

Contents: " *experiment year station S ID*
Example: " CA036 1998 WESTFORD E WF

3.2 Output Files

drudg produces the following files given an input schedule file. Refer to the detailed descriptions of the options for information on the contents of the files.

Option 2 (page 17)	Antenna-specific commands	*scheduleID*.pnt
Option 3 and 31 (page 25)	SNAP command file	*scheduleID*.snp
Options 12–16 (page 51)	SNAP procedure file	*scheduleID*.prc

The SNAP command file will be created in the directory specified in the control file's $snap section and the procedure file will be created in the directory specified in the control file's $proc directory (see section 2.4, page 3).

Remember that Unix systems are case sensitive, and if there are any upper/lower case letters in the schedule name they will be preserved into all output files.

The temporary files used by drudg are created in the temporary directory specified in the control file. If no temporary directory path is specified, the files are created in your local directory. The temporary files, if any, are deleted when you exit from the program.

3.3 Printed Output

drudg produces the following listings and printed output given an input schedule file. Refer to the detailed descriptions of the options.

Option 1 (page 16)	Schedule listing with azimuth, elevation, slew times, Mark III setup, blank line for comments
Option 6 and 61 (page 35, 40)	Bar code tape labels

drudg prints the following output listings by reading the SNAP file. The SNAP file is normally first created locally using the schedule file and option 3 (page 25) or, in rare cases, the SNAP file may be obtained from a scheduling center or the experiment PI.

Option 4 (page 31)	Compact SNAP file listing (all SNAP commands are listed)
Option 5 (page 32)	Summary of SNAP file (one observation per line)
Option 6 and 61 (page 35, 40)	Bar code tape labels

All of the printed output goes to the printer or file as displayed with option 9 (page 43). If you don't make any change with option 9, `drudg` uses the default output destination as found in the control file. Printed tape labels are sent to the printer type specified in the control file.

3.4 Running drudg Interactively

Normally you only need to type the program name after a system prompt, for example:

```
prompt> drudg
```

You can also specify the schedule file on the command line:

`prompt>` **`drudg`** *schedule* Example: **`drudg ca036`**

`drudg` first reads the system control file, then it attempts to read your personal control file. `drudg` looks for the personal control file in the local directory from which you are running. Refer to Section 2.4 (page 3) for information on the control file and how to use it. If neither control file is present, `drudg` defaults all the information it needs, except for the label printer and label size.

If you did not give the schedule file on the command line, then the first prompt from `drudg` is for the name of the schedule file:

```
Schedule file name (.skd or .drg assumed, <return> if none, :: to quit) ?
```

The user's response to this prompt is either 1) type a schedule file name or 2) press **`Return`** to indicate a SNAP file, as described in the two subsections below.

3.4.1 Input Schedule File

If you are using a schedule file as input, enter the name of the file. (If you are using a SNAP file as input, see the next subsection.) You do not have to enter the extension if the file name follows the conventions described in Section 3.1 (page 7).

As the schedule file is read, the section names are listed on the screen. drudg displays the schedule name followed by the numbers of sources, stations, observations, and frequency codes. Example:

```
$EXPER CA036
$SKED
$SOURCES
STATIONS
$CODES
Number of sources:    56
Number of stations:     5
Number of frequency codes:       1
Total number of scans in this schedule: 356
```

For a VEX file, the number of observations is not displayed at this point because the scans are not read until the station is specified.

If the header of the schedule file contains the parameter EARLY with a non-zero value, the following line appears:

```
NOTE: This schedule was created using early start with EARLY = 20 seconds.
```

where the actual value of the EARLY parameter will be printed.

If the schedule uses "adaptive" tape motion, the following line appears:

```
NOTE: This schedule uses ADAPTIVE tape motion.
      Gap time = 5 seconds.
```

where the actual value of the GAP parameter will be printed.

drudg uses the same routines as sked does to read the schedule file and so the same error messages, if any, would appear. However, drudg continues execution and treats the messages as warnings only. You should exercise caution if you see any error messages as the schedule is being read.

drudg then displays the available station identifiers (and the station full names) and asks for the one to be processed. Type one of the IDs listed. Note that the IDs are *not* case sensitive. You can also type **=** to process all stations. If you enter **=**, drudg will process each station sequentially for any option you choose. If you enter **::**, drudg will quit.

If you have a VEX file as input, `drudg` will list the number of scans for the selected station and the total number of scans in the schedule:

```
Number of scans for this station:   42
Total number of scans in this schedule:   86
```

3.4.2 Input SNAP File

If you are using a SNAP file as input, press `Return` at the initial prompt for a schedule file, i.e. you have no schedule file. You are then prompted for a schedule name and station name so that `drudg` can find the appropriate SNAP file:

```
Enter schedule name (e.g. ca036):
Enter station ID (e.g. Wf, :: to quit)?
```

`drudg` will assume that the SNAP file is named *scheduleID*`.snp`, e.g. `ca036wf.snp`. The existence of this file is not checked until you select an option that uses it. See section 3.1.2 (page 8) for how the SNAP file names are formed.

If you have a SNAP file with a non-standard name, for example `shift.snp`, enter the file name, without extension, as the schedule name and enter a blank station ID. Then `drudg` will construct the name *schedule*`.snp`.

3.5 Options Display

The next prompt is for the kind of output desired. The display shows the name of the schedule you are working on and the name of the selected station. The initial examples below assume that you have set up the control file to indicate printing tape labels using the PostScript option. The full display of options looks like this:

```
Select DRUDG option for schedule test.skd at NRAO20

1 = Print the schedule                7 = Re-specify stations
2 = Make antenna pointing file        8 = Get a new schedule file
3 = Make Mark III/IV SNAP file (.SNP) 9 = Change output destination, format
31= Make VLBA SNAP file (.SNP)       10 = Shift the .SKD file
4 = Print complete .SNP file         11 = Shift the .SNP file
5 = Print summary of .SNP file       12 = Make Mark III procedures (.PRC)
6 = Make PostScript label file       13 = Make VLBA procedures (.PRC)
61= Print PostScript label file      14 = Make hybrid procedures (.PRC)
                                     15 = Make Mark IV procedures (.PRC)
```

```
0 = Done with DRUDG                  16 = Make 8-BBC procedures (.PRC)
```

If you are using a SNAP file the options are restricted to the following:

```
Select DRUDG option for experiment test at gn

4 = Print complete .SNP file          7 = Re-specify stations
5 = Print summary of .SNP file        8 = Get a new schedule file
6 = Make PostScript label file        9 = Change output destination, format
61= Print PostScript label file      11 = Shift the .SNP file
0 = Done with DRUDG
```

If your input file is a VEX file, then you will not need to specify the type of equipment at your station with different options, so the list looks like the following:

```
Select DRUDG option for schedule gm31.skd at JODRELL1

Supporting VEX 1.5
1 = Print the schedule                7 = Re-specify stations
2 = Make antenna pointing file        8 = Get a new schedule file
3 = Create SNAP command file (.SNP)   9 = Change output destination, format
4 = Print complete .SNP file         10 = Shift the .SKD file
5 = Print summary of .SNP file       11 = Shift the .SNP file
6 = Make PostScript label file       12 = Make procedures (.PRC)
61= Print PostScript label file
0 = Done with DRUDG
 ?
```

If your control file specified a laser printer with barcode cartridge or an Epson printer for tape labels then you will see option 6 as

```
6 = Make tape labels
```

and there will be no option 61. Please refer to the description of option 6 (page 35) of this manual.

You respond to this display by typing the number corresponding to the job you want done. It is possible to go back to selection of stations (option 7, page 41) or to get a new schedule file (option 8, page 42) without leaving `drudg`. You can also change the output destination and format (option 9, page 43).

Normally, a response of `::` (or other input as given in the prompt) to any of the prompts as the options are executing will return you to this menu. Option 0 terminates `drudg`.

3.6 Running drudg Non-interactively

`drudg` can be run non-interactively to execute one command. All of the inputs that the user would type interactively, separated by spaces, are entered on the command line. `drudg` interprets each field on the command line as if it were an entry typed interactively, and it executes the appropriate command. It is recommended that you first become familiar with the responses needed interactively, and then use the command line method.

In non-interactive mode `drudg` checks for valid inputs and will stop if there is an error. An error message indicating the source of the problem is printed just before the program terminates. For example, if the schedule file is not present an error message is printed and the program stops, even though interactive mode the user would be re-prompted to enter a valid file name.

In non-interactive mode, `drudg` always overwrites any existing output files, whereas the interactive version reque sts confirmation from the user. The options for re-selecting stations or schedule files or for shifting schedules are not available in non-interactive mode.

The table below is a summary of the options that can be invoked non-interactively. An example command line is listed for each option that is valid in non-interactive mode. Only a schedule file is accepted in non-interactive mode; SNAP file input is not supported.

Example command line	Function
`drudg ca036 wf 1`	Print schedule listing (option 1)
`drudg ca036 gw 2 3`	Make pointing file (option 2, station 3)
`drudg ca036 wf 3 n`	Make SNAP command file (option 3, no parity)
`drudg ca036 wf 4`	Print entire SNAP file (option 4)
`drudg ca036 wf 5`	Print SNAP file summary (option 5)
`drudg ca036 wf 6 1`	Print tape labels (option 6, first position)
`drudg ca036 wf 12`	ake Mark III/IV procedures (option 12)
`drudg ca036 gc 13`	Make VLBA procedures (option 13)

As mentioned above, any existing SNAP file, pointing file, or procedure file would be overwritten by options 3, 2, or 12-16, respectively.

4.0 DRUDG Options

Each subsection in this section describes one of the `drudg` options.

Option 1: Print the schedule

Option 1 produces a printed listing of the schedule. The display type (see option 9) determines the size of the characters in the output and also which information is printed in the listing.

The first page of the printed schedule contains the station name, location, and slew rates and limit stops used in calculating the numbers in the schedule listing. A description of the entries for each observation is also provided. Note that these items are taken verbatim from the schedule file.

The second page is a list of the source positions used, both 1950 and J2000, as well as positions precessed to the starting date of the experiment. The source positions are output to 0.001 seconds of time for right ascension and 0.01 seconds of arc for declination. If portrait output was forced with Option 9 (page 43) or in the control file, the J2000 positions are omitted.

Following the two header pages, each observation is listed, one per line. Included are the observation start and stop times; the source name and right ascension, declination, hour angle, azimuth, and elevation at the start of the observation; the slewing time from the previous observation; and the Mark III configuration information. The remainder of each line is space for written operator comments. If either portrait output or a large font was specified in Option 9 or in the control file, the source RA and Dec are omitted.

The number of scans listed per page depends on the format orientation and the font size. Both can be specified interactively with Option 9 (page 43) or set up in the control file in the `$print` section on the `option1` line. Following the key word is a two-character field where the first character is either `p` or `l` (portrait or landscape) for the orientation and the second character is either `s` or `l` (small or large) for the font size. If the option is not specified in the control file the default is

```
option1 ls
```

Totals of the number of tapes and the number of scans are printed at the end of the listing.

If the schedule was written with early start tapes, a message is printed at the top of each page as a reminder.

Option 2: Make antenna pointing file

For those sites for which a special pointing format has been specified, `drudg` will produce the appropriate output. You are prompted for the antenna you want output for:

```
Select station for pointing output:
1 - NRAO 85-3
2 - NRAO 140
3 - DSN stations
6 - VLBA antenna
0 - QUIT
```

Selection 1 is for the 85-3 antenna at Green Bank, selection2 for the 140-foot antenna. Selection 3 is used to generate the two predicts files for DSN sites. Selection 6 is for the NRAO VLBA antenna sites. The other options are obsolete and are no longer listed as options.

You can select an antenna which you are not currently processing in `drudg`, but you'll end up with an empty file.

Output File Names

For DSN output, there are two output files created with the names:

scheduleID`.nss` Example: `cb301ti.nss`
scheduleID`.sum` Example: `cb301ti.sum`

For VLBA output, the file is named:

schedule.ID Example: `rdv02.fd`

The output for the NRAO 85-3 antenna is named:

schedule`.853` Example: `na053nw.853`

The output for the NRAO 140 antenna is named:

schedule`.pnt` Example: `cs2gb.pnt`

These files are created in the local directory from which you run `drudg`.
If the pointing file already exists, you are asked if it is OK to purge it first. If you don't want to delete the file, you are returned to the main menu. In non-interactive mode, any existing file is automatically deleted.

The following sections describe in some detail the output formats for VLBA and DSN pointing control files. In both cases the formats follow specifications provided by NRAO and JPL, respectively. Normally these institutions produce their own pointing control files, but in some special cases they allow `drudg` output to be used at their stations.

VLBA Header Commands

This section describes and gives examples of the commands that are generated by `drudg` for VLBA observing files. These commands are similar in concept to the SNAP set-up procedures such as `SX2C1`.

Each output line is no more than 80 characters long, so the longer commands will be split and a second command line written out. The long commands that list each channel number are split at either 4 or 8 channels. For the `drudg` implementation, a single setup is assumed for a schedule, i.e. a single frequency code.

The information for the header lines that `drudg` creates is taken from the `$VLBA` and `$CODES` sections of the schedule file. Refer to the **Standard Schedule File Format** manual and the **sked's Catalogs** manual for the format details. The first four lines are comments, in the same format as those that head the SNAP file.

```
* comment with experiment, year, station, ID
* comment with antenna information from SKED catalog
* comment with position information from SKED catalog
* comment with equipment information from SKED catalog
* comment with station name and frequency code
program = experiment name
nchan = number of "B" lines
format = MARKIII or VLBA
bits = (n,1), ... where n=1 to nchan
samplerate = 2*vcbandwidthM
period = (n,1), ...  where n=1 to nchan
bbfilter = (n,vcbandwidth M), ...  where n=1 to nchan
level = (n,-1), ...  where n=1 to nchan
baseband = (n,BBC#(n)), ... where n=1 to nchan
ifchan = (n,IFchan(n)), ... where n=1 to nchan
sideband = (n,SB(n)), ... where n=1 to nchan
```

```
bbsynth = (n,VCfreq(vc(n))-Synth(n)), ...  if SB(n)=U
      or  (n,Synth(n)-VCfreq(vc(n))), ...  if SB(n)=L
      where n=1 to nchan for unswitched sequences
logging = standard
```

The following additional lines are generated for VLBA antenna sites.

```
fe = (1,13cm),(2,4cm),(3,13cm),(4,4cm)   if the RF frequencies are between
                                         2-3 GHz or 8-9 GHz
!* Unknown front end                  if the RF frequencies are outside the
                                      S/X range
noise = (1,low-s),(2,low-s),(3,low-s),(4,low-s)        for all codes
pcal = 1MHz                           standard for geodetic Mark III
synth = (m,Synth(m)/1000), ...        where  m=1 to nsynth, nsynth=largest
                                      value of Syn#
ifdistr = (1,0),(2,0),(3,0),(4,0)     for all codes
pcalxbit ...                          sets up phase cal
pcalxfreq ...                         sets up phase cal
fexfer = (2,split)                    for switched frequency sequences only
```

For an 8-channel set-up for Mark III recording format, the following sample header lines would be created.

```
!* SATL-ALT  1993 HN-VLBA   D
!* D  HN-VLBA  AZEL 2.0000 90.0     0 270.0 810.0 30.0     0 2.3 90.0 25.0 HN
!* HN HN-VLBA   1446375.12430 -4447939.69180  4322306.07440 76185001
!* HN HN-VLBA  1217640
!* HN-VLBA  ASTRM2SX
program = SATL-ALT
nchan =  8
format = MARKIII
bits = (1,1),(2,1),(3,1),(4,1),(5,1),(6,1),(7,1),(8,1)
samplerate = 4M
period = (1,1),(2,1),(3,1),(4,1),(5,1),(6,1),(7,1),(8,1)
bbfilter = (1,2M),(2,2M),(3,2M),(4,2M),(5,2M),(6,2M),(7,2M),(8,2M)
level = (1,-1),(2,-1),(3,-1),(4,-1),(5,-1),(6,-1),(7,-1),(8,-1)
baseband = (1,1),(2,2),(3,3),(4,4),(5,5),(6,6),(7,7),(8,8)
ifchan = (1,B),(2,B),(3,B),(4,B),(5,A),(6,A),(7,A),(8,A)
sideband = (1,U),(2,U),(3,U),(4,U),(5,L),(6,L),(7,L),(8,L)
bbsynth = (1,610.99),(2,700.99),(3,940.99),(4,970.99),(5,679.01)
bbsynth = (6,669.01),(7,589.01),(8,559.01)
fe = (1,13cm),(2,4cm),(3,13cm),(4,4cm)
noise = (1,low-s),(2,low-s),(3,low-s),(4,low-s)
pcal = 1MHZ
synth = (1,7.6),(2,2.9)
ifdistr = (1,0),(2,0),(3,0),(4,0)
```

```
pcalxbit1=(1,S1),(2,S3),(3,S5),(4,S7),(5,S1),(6,S3),(7,S5),(8,S7)
pcalxbit2=(1,S2),(2,S4),(3,S6),(4,S8),(5,S2),(6,S4),(7,S6),(8,S8)
pcalxfreq1=(1,10),(2,10),(3,10),(4,10),(5,10),(6,10),(7,10),(8,0)
pcalxfreq2=(1,10),(2,10),(3,10),(4,10),(5,10),(6,10),(7,10),(8,0)
logging = standard
```

For a sample 14-channel geodetic station using a VLBA terminal and recording the current standard mode C frequency sequence, the following header lines would be generated:

```
!* RDAST2    1993 NRAO85_3  W
!* W  NRAO85_3 HADC 6.7034 30.0     0 -82.5 82.5 20.0     0 -45.0 88.0 25.0
WV
!* WV NRAO85_3   882325.71931 -4925137.94841  3943397.52119 72146901
!*  GB VLBA85_3 12 8820
!* NRAO85_3 ASTRM2SX
program = RDAST2
nchan = 14
format = MARKIII
bits = (1,1),(2,1),(3,1),(4,1),(5,1),(6,1),(7,1),(8,1)
bits = (9,1),(10,1),(11,1),(12,1),(13,1),(14,1)
samplerate = 4M
period = (1,1),(2,1),(3,1),(4,1),(5,1),(6,1),(7,1),(8,1)
period = (9,1),(10,1),(11,1),(12,1),(13,1),(14,1)
bbfilter = (1,2M),(2,2M),(3,2M),(4,2M),(5,2M),(6,2M),(7,2M),(8,2M)
bbfilter = (9,2M),(10,2M),(11,2M),(12,2M),(13,2M),(14,2M)
level = (1,-1),(2,-1),(3,-1),(4,-1),(5,-1),(6,-1),(7,-1),(8,-1)
level = (9,-1),(10,-1),(11,-1),(12,-1),(13,-1),(14,-1)
baseband = (1,1),(2,2),(3,3),(4,4),(5,5),(6,6),(7,7),(8,8)
baseband = (9,9),(10,10),(11,11),(12,12),(13,13),(14,14)
ifchan = (1,A),(2,A),(3,A),(4,A),(5,A),(6,A),(7,A),(8,A)
ifchan = (9,B),(10,B),(11,B),(12,B),(13,B),(14,B)
sideband = (1,U),(2,U),(3,U),(4,U),(5,U),(6,U),(7,U),(8,U)
sideband = (9,U),(10,U),(11,U),(12,U),(13,U),(14,U)
bbsynth = (1,610.99),(2,620.99),(3,650.99),(4,700.99),(5,820.99)
bbsynth = (6,940.99),(7,950.99),(8,970.99),(9,720.99),(10,730.99)
bbsynth = (11,750.99),(12,810.99),(13,840.99),(14,845.99)
pcalxbit1=(1,S1),(2,S3),(3,S5),(4,S7),(5,S9),(6,S11),(7,S13),(8,S1)
pcalxbit2=(1,S2),(2,S4),(3,S6),(4,S8),(5,S10),(6,S12),(7,S14),(8,S9)
pcalxfreq1=(1,10),(2,10),(3,10),(4,10),(5,10),(6,10),(7,10),(8,0)
pcalxfreq2=(1,10),(2,10),(3,10),(4,10),(5,10),(6,10),(7,10),(8,0)
logging = standard
```

For a VLBA recording format experiment that uses fan-out and 8 BBCs, the following header lines are produced:

```
!* RDGEO5    1996 FD-VLBA   D
```

```
!* D  FD-VLBA  AZEL 2.0000 90.0     0 270.0 810.0 30.0     0 2.3 88.0 25.0 Fd

!* Fd FD-VLBA  -1324009.17558 -5332181.91303  3231962.43049 76139801
!*  FV   FD-VLBA  1417640
!* FD-VLBA  VGEOSX
program = RDGEO5
nchan =  8
format = VLBA1:4
bits = (1,1),(2,1),(3,1),(4,1),(5,1),(6,1),(7,1),(8,1)
samplerate = 16M
period = (1,1),(2,1),(3,1),(4,1),(5,1),(6,1),(7,1),(8,1)
bbfilter = (1,8M),(2,8M),(3,8M),(4,8M),(5,8M),(6,8M),(7,8M),(8,8M)
level = (1,-1),(2,-1),(3,-1),(4,-1),(5,-1),(6,-1),(7,-1),(8,-1)
baseband = (1,1),(2,2),(3,3),(4,4),(5,5),(6,6),(7,7),(8,8)
ifchan = (1,B),(2,B),(3,B),(4,B),(5,A),(6,A),(7,A),(8,A)
sideband = (1,U),(2,U),(3,U),(4,U),(5,L),(6,L),(7,L),(8,L)
bbsynth = (1,505.99),(2,575.99),(3,890.99),(4,995.99),(5,679.01)
bbsynth = (6,659.01),(7,569.01),(8,539.01)
fe = (1,13cm),(2,4cm),(3,13cm),(4,4cm)
noise = (1,low-s),(2,low-s),(3,low-s),(4,low-s)
pcal = 1MHZ
pcalxbit1=(1,S1),(2,S3),(3,S5),(4,S7),(5,S1),(6,S3),(7,S5),(8,S7)
pcalxbit2=(1,S2),(2,S4),(3,S6),(4,S8),(5,S2),(6,S4),(7,S6),(8,S8)
pcalxfreq1=(1,10),(2,10),(3,10),(4,10),(5,7010)(6,7010),(7,7010),(8,7010)
pcalxfreq2=(1,10),(2,10),(3,10),(4,10),(5,7010)(6,7010),(7,7010),(8,7010)
synth = (1,7.9)(2,2.9)
ifdistr = (1,0),(2,0),(3,0),(4,0)
logging = standard
```

VLBA Command Blocks

`drudg` next generates two blocks of commands for each individual scan. In concept, these blocks are similar to the series of SNAP commands that are generated for each observation.

The sample commands below are listed in the order they appear in the output file. In order to minimize the length of listings, several commands are put onto a single line in the file.

```
!*  ** NEW TAPE **  *!    comment - insert when new tape is needed
date = yymondd            insert date before first scan on new day
!* Setup *!               comment - this is the setup block
dur=0s                    specify block duration for safety
qual=999                  ID for rapid data base search
stop=16h05m50s            stop time of setup block = scan start time
sname='0218+357'          8-character source name, in quotes
ra=02h21m05.3s            right ascension, J2000 position
dec=+35d56'14"            declination, J2000 position
```

```
tape=(1,speed)          speed = STOP to leave tape stopped, +/-REWIND to
                        fast forward or fast reverse to end of tape for a
                        new pass
write=(1,off)           disable recording in this block
head=(1,pos)            position the heads to pos microns
track=(chan,track)      track assignment for each channel. Note VLBA track
                        = Mark III track + 3. Specify tracks to be
                        recorded only if this scan changes direction.
!NEXT!                  end of the setup block
!* Record *!            comment - start of recording block
tape=(1,dspeed)         start tape moving, d=direction + or -, speed=tape
                        speed in feet/sec, e.g. 135 or 270, or speed=RUN
write=(1,on)            enable recording
head=(1,pos)            specify head position pos in microns
dur= 0s                 block duration, set to 0 for safety
qual=1                  ID for later data base search
stop=16h12m22s          stop time of block = stop time of scan
!NEXT!                  end of record block
```

If the tape needs to be positioned to a new footage before the next scan, two additional blocks are output between the setup and record blocks. The stop time of the setup block is changed to be just after the stop time of the previous run block. A "spin" block then moves the tape at rewind speed, and the stop time of the block occurs when the tape should be approximately positioned to the required footage. Then a "wait" block suspends processing until the start time of the observation and the record block. The commands are:

```
!* Spin *!               comment - this is the spin block
dur=0s
qual=888                special qualifier for this block
stop=14h23m00s          time is stop time of previous run + spin
tape=(1,dREWIND)        d=direction + or -
write=(1,off)           disable recording
head=(1,pos)            current head position
!NEXT!                  end of spin block
!* Wait *!              comment - this is the wait block
dur=0s
qual=888
stop=14h32m10s          block stop time is start time of scan
tape=(1,STOP)           stop the tape
write=(1,off)
head=(1,pos)
!NEXT!                  end of wait block
```

DSN Summary Listing

The "summary" file for DSN output is a simple listing of scan start and stop times, plus the source name and instructions for manually running the tape recorder. Tape changes are also marked in the listing. The following partial listing is an example output.

```
 Start      Stop      Source    Instruction for 1st time-  for 2nd time

                *** NEW TAPE #  1 ***

 20: 0:25 - 20: 2:10   1739+522    Press FORWARD & RECORD  -  Press STOP
 20: 7:45 - 20: 9:30   2234+282    Press FORWARD & RECORD  -  Press STOP
 20:12:35 - 20:14:20   1622-253    Press FORWARD & RECORD  -  Press STOP
 20:19:15 - 20:21: 0   1308+326    Press FORWARD & RECORD  -  Press STOP
 20:28: 5 - 20:29:50   1606+106    Press FORWARD & RECORD  -  Press STOP
 20:32:35 - 20:34:20   1739+522    Press FORWARD & RECORD  -  Press STOP
```

DSN Network File

The network support output file contains the "predicts" required by the DSN station to operate a VLBI experiment. The file consists of three sections: 1) a listing of the source coordinates, 2) observing parameters for each scan, and 3) setup parameters such as observing frequencies, power levels, and switch settings.

The first section is labeled `RS CATALOG` and has the format shown in the following partial listing. There is one line per source, having the source name followed by right ascension, declination, and epoch. The format is as shown in the sample listing:

```
** RS CATALOG                                                      J2000
 0119+041       1:21:56.861565  + 4:22:24.72891                  2000.0
 0229+131       2:31:45.893913  +13:22:54.71059                  2000.0
 0454-234       4:57: 3.179198  -23:24:52.02376                  2000.0
 0458-020       5: 1:12.809753  - 1:59:14.26002                  2000.0
 0528+134       5:30:56.416534  +13:31:55.14596                  2000.0
```

The second section is labelled `OBSEQ` and contains a listing of the scans to be observed, in time order. The format of the first line in this section is:

```
*OBSEQ WBRADIOASTRY <exper> <ID> yyyy/ddd hh:mm:ss <dut> <eeq> <epoch>
```

where `<exper>` is the experiment name, `<ID>` is the DSN station number, and `<epoch>` is the epoch of the radio source positions in this section. The date and time fields following the station number are the nominal start time of the experiment. The fields for UT and the equation of the equinoxes (`<dut>`

and <eeq>) are set to zero so that the DSN software will automatically calculate them. The remainder of this section contains one line per scan, in the format:

```
<source> <ra> <dec> <prev-stop> <stop> <start> <stop> 12 <c> <type>
```

where <source>, <ra>, <dec> are the source name, right ascension, and declination, respectively; <prev-stop> is the stop time of the previous scan, <stop> is the stop time of the present scan (the one described on this line), and <start> is the start time of the present scan. The 12 on this line means there are 12 passes on the tape. The field <c> indicates the azimuth cable wrap: CW means the antenna should be on the clockwise wrap, CCW means the antenna should be on the counterclockwise wrap, and a blank means the antenna should be on the non-overlapped portion of the cable. Clockwise and counterclockwise are directions from the central point of the cable as looking down on the antenna. The <type> field has the following meaning: 1 = same recording direction as previous scan, 2 = start a new tape, 3 = change direction but stay on the same pass, 4 = change direction and start a new pass. There is no way to control the offset position of the headstack; instead, the headstack is positioned to the next available position whenever a new pass is started.

A partial listing of a sample file follows.

```
*OBSEQ WBRADIOASTRY EUROP4       65          1994/243 20: 0:40   .00000   .00000 2000
```

The third section of the file contains equipment setup information. A typical sample file is listed below, with comments added at the end of each line that indicate what the contents of the fields are. The values that are taken from the schedule file are indicated with a description. The items marked as "fixed values" are output by drudg as constants and do not depend on the particular experiment.

```
$FREQUENCIES
BAND    = 8*2, 6*1,                     (indices of video converters assigned
                                           to which IF, X=2, S=1)
BIAS    = 8*8100.000000000000    , 6*2000.000000000000    ,
                                           (LO frequencies for X and S)
DWELL   = 14*0.0000000000000000E+00, (fixed value)
ONEWAYFREQ      =   110990000.0000000    ,   120990000.0000000    ,
  150990000.0000000    ,  210990000.0000000    ,  320990000.0000000    ,
  400990000.0000000    ,  450990000.0000000    ,  470990000.0000000    ,
  212990000.0000000    ,  222990000.0000000    ,  237990000.0000000    ,
  267990000.0000000    ,  292990000.0000000    ,  297990000.0000000    ,

                                           (video converter frequencies, in Hz)
STATIONID       =       65              (station number, e.g. this is DSS65)
$END
$CONFIGDATA
AMPNUMBER1      =          1,           (fixed value)
AMPNUMBER2      =          2,           (fixed value)
AMPSELECT1      = 'MAS',                (fixed value)
```

```
AMPSELECT2      = 'MAS',                (fixed value)
BANDCOMB        = 'OFF',                (fixed value)
DRIFT1  =  0.1494000    ,            (fixed value)
DRIFT2  =  0.2968000    ,            (fixed value)
JITTERTHRESH1   =         10,           (fixed value)
JITTERTHRESH2   =         20,           (fixed value)
MAGTOLER1       =  7.0000000000000000E-03,           (fixed value)
MAGTOLER2       =  7.0000000000000000E-03,           (fixed value)
PCGCOMBDIV1     =          5,           (fixed value)
PCGCOMBDIV2     =          5,           (fixed value)
PCGPOWER1       =   6.000000    ,     (fixed value)
PCGPOWER2       =   6.000000    ,     (fixed value)
POLARIZ1        = 'RCP',                (fixed value)
POLARIZ2        = 'RCP',                (fixed value)
RECORDERMODE    = 'C',                  (formatter mode, from schedule)
SAMPLERATE      =     4000000,       (formatter rate, in Hz)
TESTWORD        =        12,        34,    56,      78,  (fixed value)
WCBINSRC1N      =         2,          (fixed value)
WCBINSRC2N      =         3,          (fixed value)
SESSIONTYPE     = 'WBRADIOASTRY',     (fixed value)
STATIONID       =        65,          (station number, e.g. this is DSS65)
WCBIF1SEL       = 'NOR',                (normal or alternate IF input)
WCBIF2SEL       = 'NOR',                (normal or alternate IF input)
WCBVCINP        = 4*'2LO', 4*'2HI', 1*'1LO', 5*'1HI',    (video-to-IF patching)
WCBVCBW =   2.000000    ,            (video converter bandwidth)
WCBAUXDAT       = 'WCBAUXDAT   ',     (fixed value)
WCBFRQ15        =   110990000.0000000   (fixed value)
$END
```

Option 3 and 31: Make SNAP file (.SNP)

Under Options 3 or 31, `drudg` generates for each observation a series of SNAP commands for setting up the VLBI equipment. Option 3 is for stations that have Mark III or Mark IV systems and Option 31 is for stations that have VLBA systems. Stations with a Mark III rack and VLBA recorder would use Option 3.

If your schedule is a VEX file, only Option 3 is displayed because information about the station equipment is taken from the VEX file and you do not need to specify it.

Output File Names

The SNAP commands are written into a file with the name

scheduleID`.snp` Example: `ca036wf.snp`

This file will be created in the directory, if any, that was specified in the `$snap` section of the control file. If no directory was specified, the file will be created in the local directory. If the file already exists, you are asked if it is OK to purge it first. In non-interactive mode any existing file is always purged first.

The first four lines of the output SNAP file written by `drudg` are comments which are read by the Field System and echoed into the log file. These lines contain copies of the `A`, `P` and `T` lines as found in the schedule file. This is provided as supplemental information for the Field System. The first line is essential for experiments to be processed at a Mark III correlator because this is where the program `vlogx` finds the 1-letter station ID in the log file.

Prompt for Parity Checks

After you select option 3 or 31, `drudg` determines what type of parity checks were requested by the scheduler. If the schedule is set up for parity checks (see more about this below) then `drudg` prints the following message:

```
Parity checks will be inserted after the first scan of each pass,
if there is enough time to do them.
Add more parity checks whenever there is enough time?
Enter Y or N, 0 to quit ? [default N]
```

If the schedule does not request any parity checks, then `drudg` prints this message instead:

```
No parity checks will be inserted unless you request them
with the following response.
Insert parity checks whenever there is enough time?
Enter Y or N, 0 to quit ? [default N]
```

If you respond with **N** or press **Return**, and if the scheduling program has allowed enough time for a parity check on the first scan of a pass, then drudg will put the parity check procedure into the SNAP file for only these scans. If you respond with **Y**, then the parity check procedure will be inserted whenever there is time for it and not just on the first scan of a pass.

Note that drudg will never insert a parity check if there is not enough time for it, regardless of how the schedule is set up. (But, see below for how drudg calculates "enough time".)

If your station has an S2 recorder, drudg will not prompt for parity checks.

Procedure Timing and Parity Checks

drudg reads the following parameter times from the schedule file $PARAMETER section. These timing values, plus any tape spinning time, are used to determine whether enough time is available for the check procedures. If these parameters are not found in the schedule file, such as is always the case for .drg files or (currently) for VEX files, then drudg defaults them to the following reasonable values:

name	default	meaning
PARITY	70 seconds	time allowed for a parity check
SOURCE	5 seconds	time to process the new source command
TAPE	1 second	time to process the tape monitor command
HEAD	6 seconds	time to move the heads to another index position
SETUP	20 seconds	time to perform the setup procedure before a scan
CAL	10 seconds	time to perform the calibration or PREOB procedure
EARLY	0 seconds	time to start moving the tape before the data start time
LATE	0 seconds	time to wait before stopping the tape after the data end time
GAP	0 seconds	longest time allowed between scans for continuous tape motion

If the type of tape motion is not specified, then it is defaulted to start&stop. The other supported choice is adaptive.

It is assumed by sked and drudg that EARLY is longer than CAL, i.e. if the tape is going to start early then it will be started before the pre-observation procedure.

drudg uses the parameter times listed above plus any time needed to position the tape at hig speed ("spin" time) to determine if there is enough time for a parity check using the following algorithm:

"Enough time for a parity check" means that
the time between
the end-tape time of the previous scan and
the start of the next PREOB or early tape start
is longer than
PARITY+SETUP+HEAD+SOURCE+TAPE+spin

Procedure Flags

One field of each scan line in the $SKED section of the schedule file is a four-character string of Y's and N's. The flags are set by the scheduling program to indicate on an individual scan basis whether certain procedures are to be invoked during the schedule and whether enough time was allowed in the schedule for execution of the procedure.

The flags have the following meaning:

Flag 1	Y = Do setup on every observation (sked and PC-SCHED default) N = Do setup only when tape changes direction, or if a parity check was just done (so that the modules are set up properly)
Flag 2	Y = Do a parity check after first observation of a pass (sked default) N = No time specifically allowed for parity checks by sked, but drudg inserts them if requested (see description above)
Flag 3	Y = Do tape prepass N = No time allowed for prepass
Flag 4	Removed. Formerly used for the PEAK procedure.

The current default for geodetic schedules written by sked is to use YYNN. Files written by PC-SCHED have this field set to YNNN. When a VEX file is read by drudg, these flags are defaulted to YNNN.

Procedure and Command Naming Codes

The definitions of code letters used in generating the SNAP procedures names and commands are listed in the following table. Refer to Option 12 (page 51) for how the different procedure names are formed.

ff 2-letter frequency code or observing mode code.

p subpass number (for Mark III modes) or letter (for VLBA/Mark IV modes)

c channel bandwidth, one of `1`, `2`, `4`, `8`, `d` (16 MHz or "d"ouble), `h` (0.5 MHz or "h"alf), `q` (0.25 MHz or "q"uarter), `e` (0.125 MHz or "e"ighth).

m 1-letter code for the mode, `A`–`E` for Mark III, `V` for VLBA non-data-replacement modes, `M` for Mark IV data-replacement modes or non-standard Mark III modes (lower sideband LOs or racks with only 8 BBCs).

nn fan-out, either `14`, `12`, `11`, or null if none.

dir direction the tape will move, either `for` or `rev`

d direction the tape will move, either `f` or `r`

speed speed of the tape in inches per second, calculated using the following formula:

speed = ohfac × r /(bitdens × n)

where

ohfac = 9/8 for Mark III/IV data-replacement format
= 9.072/8 for VLBA non-data-replacement format

n = fanout factor, either 1, 2, or 4

r = sample rate in bits/sec

bitdens = bit density in bpi
33333 for Mark III/IV data-replacement modes (thick tape)
34020 for VLBA non-data-replacement modes (thick tape)
56250 for Mark III/IV data-replacement modes (thin tape)
56700 for VLBA non-data-replacement modes (thin tape)

Note that bit density depends on the recording mode, not on the station equipment, but remember that Mark IV equipment can only record in data-replacement modes while VLBA equipment can do either mode. The high density modes *require* thin tape to be used.

Commands in the SNAP File

The definitions of various timing values used in generating the SNAP commands are listed below:

start_time Start time of good data.

preob_time *data_start* – `CAL`

early_start *data_start* – `EARLY`

stop_time Ending time of good data

late_stop *stop_time* + `LATE`

spin_time Time required to move the tape at high speed to a new footage

gap time between *late_stop* for current scan and *early_start* for next scan

The specific commands which `drudg` produces in the SNAP file for a single scan are as follows:

if a normal celestial source:
`source=`*name,ra,dec,dpoch* (position is precessed to the epoch in the control file)
if a satellite:
`source=azel,`*az*`d,`*el*`d` (calculate *az* and *el* as of *start_time*)
if adaptive tape motion, and *gap* > `GAP`, and `LATE` > 0:
`!`*late_stop* (for S2 recorder, using stop time from the previous scan)
`et`
if tape direction changes for this scan:
`midtp` (if this scan changes direction)
if this scan starts a new tape:
`fastr=`*spin_time* (if the tape is more than 50 feet from the end)
`unlod` (if this scan starts a new tape)
if the parity flag (flag 2) is set and there is enough time (see page 27):
`check2`*mp* (parity check procedure, see above for other conditions under which this is invoked)
if the setup flag is set (flag 1):
ffcmnnp (setup procedure, see above for other conditions under which this is invoked, see Option 12 for contents)
`setup`*ff* (name of the setup procedure if S2 recorder)
if starting a new tape:
`ready` (load the new tape)
`fastf=`*spin_time* (if the tape is more than 100 feet from desired footage)
if the prepass flag (flag 3) is set:
`prepass` (prepass the tape)
If S2:
`loader` (for S2 recorder, if group change since the last pass)
if tape needs positioning:
`fast`*d*`=`*spin_time* (position the tape at high speed, *d* is `f` or `r`)
if `EARLY` > 0:
`!`*early_start* (wait until early start time)
`tape` (record the tape footage at early start time)
`st=`*dir,speed* (start recording at early start time)
if `CAL` > 0:
`!`*preob_time* (wait until `CAL` time before start time)
preob (pre-observation procedure)

!*start_time*	(wait until good data start time)
data_valid=on	(for S2 recorders)
tape	(record tape footage at data start time)
st=*dir,speed*	(start the tape, even if already started at the early start time)
midob	(mid-observation procedure)
!*stop_time*	(wait until data stop time)

if normal start&stop tape motion, or if adaptive tape motion and *gap* > GAP:

et	(stop the tape)
!+3s	(wait for the tape to come to a stop)
tape	(record footage at the data stop time)
data_valid=off	(for S2 recorders)
postob	(post-observation procedure)

All of the information for generating the above commands is taken from the schedule file. This series of SNAP commands allows a procedure to be invoked before the observation begins (preob) to set up equipment and to do radiometry, and a procedure to be invoked once the observation is started (midob) for cable calibration and weather measurements. The ready procedure contains a halt which halts the schedule until the tape is mounted and the operator types in the tape label. The unlod procedure spins the tape off the reel. The midtp procedure is normally empty unless you wish to do something in the middle of each tape. The fastf and fastr procedures are used to position the tape in case a run is skipped due to subnetting. See the **Field System** manuals for a description of the standard contents of these procedures.

Option 4: Print complete list of .SNP file

A compact printer listing of the SNAP command file is produced with this option of DRUDG. `drudg` looks for a file named

scheduleID`.snp`

`drudg` looks for this file in the directory specified in the `$snap` section of the control file (see section 2.4, page 3). If no directory is specified, it looks in the local directory.

The output listing prints the commands across the page for compactness. The line numbers, which are often required in the field, are listed for the `SOURCE` command which begins an observation sequence.

The number of commands on a line is determined by selection of format in Option 9 (page 43) or in the control file (Section 2.4, page 3). As many commands as will fit across the page are printed on one line and continued on the next one(s). The format is specified in the control file in the `$print` section on the `option4` line. Following the key word is a two-character field where the first character is either `p` or `l` (portrait or landscape) for the orientation and the second character is either `s` or `l` (small or large) for the font size. If the option is not specified in the control file the default is

```
option4 ps
```

for portrait orientation, small font.

Note that Option 5 (page 32) produces a very useful schedule summary. The listing summarizes each observation on one line. The SNAP line number of the `SOURCE` commands is given, and new tapes and parity checks are indicated. Even if your station does not use a SNAP file, this very useful summary listing can be produced by first invoking Option 3 (page 25) to generate a SNAP file and then using Option 5 to make the listing.

Option 5: Print summary list of .SNP file

For this option, the SNAP file is read and an output listing is produced. This is a summary listing of the schedule, one line per observation. `drudg` looks for a file named

scheduleID`.snp`

`drudg` looks for this file in the directory specified in the `$snap` section of the control file (see section 2.4, page 3). If no directory is specified, it looks in the local directory.

The listing includes source name, azimuth, elevation, tape start time, observation start time, end time, and duration. Also listed are tape pass, direction, and footage count at the start of the observation. Tape changes are marked with `XXX` in the right-hand column. Also in this column is an `*` for observations for which a parity check appears in the schedule. The parity check will occur at the beginning of the marked observation, that is, the data for the previous observation is being checked.

The number of lines per page depends on the orientation and font size, specified either in the control file or interactively with Option 9 (page 43). The format is specified in the control file in the `$print` section on the `option5` line. Following the key word is a two-character field where the first character is either `p` or `l` (portrait or landscape) for the orientation and the second character is either `s` or `l` (small or large) for the font size. If the option is not specified in the control file the default is

```
option5 ps
```

for portrait orientation, small font.

To produce the az and el values, `drudg` uses the station positions found in the schedule file.

If you are using this option with a SNAP file as input and do not have a schedule file, then `drudg` looks for a comment at the start of the SNAP file that has the station position. If you produced the SNAP file with `drudg`, then that line will automatically be output in the correct format. If the station position is not found, `drudg` cannot compute the az and el. The contents of the required line:

Contents: "*code name X Y Z*
Example: `" AL GILCREEK -2281547.10306 -1453645.05738  5756993.14344`

X, Y, Z are the geocentric position components of the station in meters.

This listing is the one output which explicitly shows the different times for tape start and data start in schedules written with the early tape start option. Note that Option 4 (page 31) produces a compact listing of the entire SNAP file which is useful for detailed examination of the schedule.

The following is a partial listing of the output. For stations with az-el mounted antennas, an additional column indicates the cable wrap on which the antenna should be positioned for the current observation.

```
 Schedule file: testnt.snp                                    Page   1
 Station: NOTO     (Nt)
 Experiment: EF002A
 Early tape start:   0 seconds

                              Start    Start    Stop                    Change/
 Line#  Source   Az El Cable   Tape     Data     Data    Dur Pass Dir Tape Check
-------------------------------------------------------------------------------
  Day 034
     5 2318+049 230 47 NEUTR 15:30:42 15:30:42 15:32:30 01:48  1  FOR     0 XXX
    19 1357+769 358 24 CCW   15:34:38 15:34:38 15:36:26 01:48  1  FOR  1210  *
    33 0059+581 348 68 CCW   15:37:53 15:37:53 15:39:41 01:48  2  REV  2870
    48 1726+455 324  7 CCW   15:41:49 15:41:49 15:43:37 01:48  2  REV  1650  *
    62 2234+282 271 50 CCW   15:45:32 15:45:32 15:49:08 03:36  3  FOR     0
    77 2145+067 257 28 NEUTR 15:51:45 15:51:45 15:53:33 01:48  4  REV  2880  *
    93 0014+813 355 45 CCW   15:55:41 15:55:41 15:57:29 01:48  4  REV  1660  *
   107 1803+784 348 31 CCW   15:58:56 15:58:56 16:00:44 01:48  5  FOR     0
   122 2318+049 239 41 NEUTR 16:02:52 16:02:52 16:04:40 01:48  5  FOR  1210  *
   136 1726+455 327  4 CCW   16:06:46 16:06:46 16:08:34 01:48  6  REV  2870
   151 2234+282 275 45 NEUTR 16:12:05 16:12:05 16:15:41 03:36  7  FOR     0  *
   167 2145+067 261 22 NEUTR 16:18:18 16:18:18 16:20:06 01:48  8  REV  2880  *
   183 0059+581 335 65 CCW   16:22:14 16:22:14 16:24:02 01:48  8  REV  1660  *
   197 2318+049 244 37 NEUTR 16:25:29 16:25:29 16:27:17 01:48  9  FOR     0
   212 0119+041 209 54 NEUTR 16:29:25 16:29:25 16:31:13 01:48  9  FOR  1210  *
   226 2234+282 278 41 NEUTR 16:32:40 16:32:40 16:36:16 03:36  10 REV  2870
   241 0202+149 200 67 CCW   16:38:53 16:38:53 16:40:41 01:48  11 FOR     0  *
   257 1726+455 332  1 CCW   16:42:49 16:42:49 16:44:37 01:48  11 FOR  1210  *
   271 0048-097 216 36 NEUTR 16:46:44 16:46:44 16:48:32 01:48  12 REV  2870
   286 2145+067 266 16 NEUTR 16:50:40 16:50:40 16:52:28 01:48  12 REV  1650  *

 Total number of scans:  20
 Total number of tapes:   1
```

The footages in the summary are rounded to the nearest 10 feet. The tape footages in this summary are calculated from the timings and speed in the SNAP file, and so they may not be exactly the same as the footages in the schedule file due to round-off errors. The algorithm for calculating the footages used for tape spin time is given in the section on the shift calculations (see option 10, page 46).

If the scheduler specified that the tape should not be stopped when there is a small time gap between scans, `drudg` will suppress the stop tape commands in the SNAP file. For scans that start while the tape is still moving from the previous scan, the column for the tape start will be blank because there was no `et` command in the SNAP file for the previous scan. The columns for data start and data stop still indicate when the correlator is to expect good data. A partial listing of a sample schedule is given next.

```
 Schedule file: cmvaeb.snp                                    Page   1
 Station: EFLSBERG (Eb)
 Experiment: 96-testd
 Early tape start:   0 seconds

                              Start    Start    Stop                    Change/
 Line#  Source   Az El Cable   Tape     Data     Data    Dur Pass Dir Tape Check
-------------------------------------------------------------------------------
  Day 282
     5 0827+243 252 45 NEUTR 10:00:00 10:00:00 10:06:32 06:32  1  FOR     0 XXX
    19 0827+243 257 42 NEUTR 10:20:00 10:20:00 10:26:32 06:32  2  REV  8820
    33 3C273B   177 42 NEUTR 10:40:00 10:40:00 10:46:32 06:32  3  FOR     0
    47 3C273B   183 42 NEUTR 11:00:00 11:00:00 11:06:32 06:32  4  REV  8820
    61 3C273B   190 41 NEUTR 11:20:00 11:20:00 11:26:32 06:32  5  FOR     0
    75 3C273B   197 41 NEUTR 11:40:00 11:40:00 11:46:32 06:32  6  REV  8820
    89 0804+499 304 40 NEUTR 12:00:00 12:00:00 12:06:32 06:32  7  FOR     0
   103 SGR_A    133 -3 NEUTR 12:20:00 12:20:00 12:26:32 06:32  8  REV  8820
   117 3C273B   215 36 NEUTR 12:40:00 12:40:00 12:46:32 06:32  9  FOR     0
   131 1555+001 155 37 NEUTR 13:00:00 13:00:00 13:06:32 06:32  10 REV  8820
   145 1655+077 140 41 NEUTR 13:20:00 13:20:00 13:26:32 06:32  11 FOR     0
   159 1633+38  125 72 NEUTR 13:40:00 13:40:00 13:46:32 06:32  12 REV  8820
   173 1308+326 251 57 NEUTR 14:00:00 14:00:00 14:00:56 00:56  1  FOR     0 XXX
   186 1308+328 252 57 NEUTR   :  :   14:00:56 14:01:52 00:56  1  FOR  1260
   194 1308+326 252 57 NEUTR   :  :   14:01:52 14:02:48 00:56  1  FOR  2520
   202 1308+328 252 57 NEUTR   :  :   14:02:48 14:03:44 00:56  1  FOR  3780
   210 1308+326 252 57 NEUTR   :  :   14:03:44 14:04:40 00:56  1  FOR  5040
   218 1308+328 253 57 NEUTR   :  :   14:04:40 14:05:36 00:56  1  FOR  6300
   226 1308+326 253 56 NEUTR   :  :   14:05:36 14:06:32 00:56  1  FOR  7560
   236 1308+326 256 54 NEUTR 14:20:00 14:20:00 14:20:56 00:56  2  REV  8820
   248 1308+328 257 54 NEUTR   :  :   14:20:56 14:21:52 00:56  2  REV  7560
   256 1308+326 257 54 NEUTR   :  :   14:21:52 14:22:48 00:56  2  REV  6300
   264 1308+328 257 54 NEUTR   :  :   14:22:48 14:23:44 00:56  2  REV  5040
   272 1308+326 257 54 NEUTR   :  :   14:23:44 14:24:40 00:56  2  REV  3780
   280 1308+328 258 54 NEUTR   :  :   14:24:40 14:25:36 00:56  2  REV  2520
   288 1308+326 258 53 NEUTR   :  :   14:25:36 14:26:32 00:56  2  REV  1260
   298 1308+326 261 51 NEUTR 14:40:00 14:40:00 14:40:56 00:56  3  FOR     0
   310 1308+328 261 51 NEUTR   :  :   14:40:56 14:41:52 00:56  3  FOR  1260
   318 1308+326 261 51 NEUTR   :  :   14:41:52 14:42:48 00:56  3  FOR  2520
   326 1308+328 262 51 NEUTR   :  :   14:42:48 14:43:44 00:56  3  FOR  3780
   334 1308+326 262 51 NEUTR   :  :   14:43:44 14:44:40 00:56  3  FOR  5040
   342 1308+328 262 51 NEUTR   :  :   14:44:40 14:45:36 00:56  3  FOR  6300
   350 1308+326 262 50 NEUTR   :  :   14:45:36 14:46:32 00:56  3  FOR  7560
   360 1308+326 266 47 NEUTR 15:05:00 15:05:00 15:05:56 00:56  4  REV  8820
   372 1308+328 267 47 NEUTR   :  :   15:05:56 15:06:52 00:56  4  REV  7560
   380 1308+326 267 47 NEUTR   :  :   15:06:52 15:07:48 00:56  4  REV  6300
```

```
   388 1308+328 267 47 NEUTR   :  :   15:07:48 15:08:44 00:56  4  REV  5040
   396 1308+326 267 47 NEUTR   :  :   15:08:44 15:09:40 00:56  4  REV  3780
   404 1308+328 267 47 NEUTR   :  :   15:09:40 15:10:36 00:56  4  REV  2520
   412 1308+326 268 46 NEUTR   :  :   15:10:36 15:11:32 00:56  4  REV  1260
......
```

Option 6: Make tape labels/PostScript label file

This option generates tape labels for the experiment. `Drudg` automatically prints the labels on the printer specified in the control file for laser printers with barcode cartridges or for Epson printers. For PostScript type, it creates or adds to the PostScript file, and you then use option 61 (page 40) to print the labels.

`drudg` will print barcode graphic labels that include on each label the first start time, the last stop time, the name of the station, the name of the experiment, and the sequential tape number.

If you are using a schedule file as input, `drudg` reads that file as input for making the labels and you do not need to first create a SNAP file. In the SNAP file, `drudg` looks for the `unlod` command to signal a new tape.

Types of Printer

The type of printer for labels is specified in the control file (section 2.4, page 3) in the `$printer` section. The key word is `label_printer` and recognized types (not case sensitive) are:

`Laser+barcode_cartridge`	Laser printer equipped with a barcode font cartridge
`Epson`	Epson impact printer
`Epson24`	Epson 24-pin printer
`Postscript`	Makes a PostScript file for printing with option 61

The type of printer for tape labels cannot be changed interactively. Each type of output is described in a section below.

If you specify either the option for an Epson printer or for a laser printer with a barcode font cartridge, the type of label will depend on the printer type. The specific escape codes required for either the Epson graphics or the laser printer cartridge are sent depending on the type of printer. If you specify the option for a PostScript file that can later be sent to the printer, the output does not depend on the printer type, rather the standardization of using a PostScript file makes it work.

PostScript Type

Bar code labels can be generated and printed on any printer by specifying a PostScript type for the label printer in the control file and a label size. Refer to the previous section for how to specify the printer type, and see below in this section for how to specify the label size.

The label printing is accomplished in `drudg` by writing a PostScript file that is then printed using option 61 (page 40). For most local printers, this will print properly even if the printer itself doesn't understand PostScript. For the standard configuration Field System PCs, the printer command `lpr` uses GhostScript to interpret the PostScript file and then sends the appropriate commands to the printer. This will not work for a remote printer: if you are using a remote printer, it must be one that accepts PostScript directly.

If you need to use a script or special system commands to get a PostScript file printed, then put the script name or the commands themselves into the control file (see section 2.4, page 3). In the `$print` section use the key word `labels` followed by the script name or the commands. The format of the line is:

`labels` *name_of_script_file*

or

`labels` *list_of_system_commands*

`drudg` creates a temporary tape label file named `DRlab.tmp`. The file is created in the temporary directory as specified in the control file, or, if no directory is specified, in your local directory. If the file already exists because you have used it for a previous schedule in this session of `drudg`, then `drudg` will append to it. If you continue to bring in new schedules with Option 8 (page 42) and append to the tape label file, you can generate labels for more than one experiment and then print them all at once with option 61 (page 40).

`Drudg` formats the tape labels using information about the label stock provided in the control file (see section 2.4, page 3). The keyword is `label_size` and you specify six values on this line in the following format:

`label_size` *height width rows cols top_offset left_offset*

height	Height of an individual label, in inches.
width	Width of an individual label, in inches.
rows	Number of rows of labels on one sheet.

cols	Number of columns of labels on one sheet.
top_offset	Offset of the first label's corner from the top of the sheet.
left_offset	Offset of the first label's edge from the left of the sheet.

Examples for several types of label sheets are provided in the distributed control file. You can edit these or specify new values for the type of sheets that you have locally. Please try this on plain paper first to make sure you have the dimensions and offsets correct. You should be able to adjust the values to make tape labels that fit almost any type of stock.

When selecting label stock, there are several considerations that should be kept in mind. The label needs to be large enough that the bar code characters will fit on it, but it must not be larger than the allocated space on the label carrier on the tape. The recommended minimum and maximum sizes are:

Recommended minimum label size: 1.5 x 2.8 inches (labels in 10 rows, 3 columns)
Recommended maximum label size: 2.5 x 4.0 inches (labels in 4 rows, 2 columns)

`Drudg` adjusts the font size for the text and the width of the bar code characters depending on the label size:

Label width < 4 inches	8-pt font	barcode ½ inches high, ~2 inches wide
Label width >= 4 inches	10-pt font	barcode ½ inches high, ~3 inches wide

The bar code itself is always printed ½ inches high, which is a recommended minimum size for wiping the reader across the the label.

Refer to the instructions in the section below (page 38) for feeding label stock into the printer.

Laser Printer with Font Cartridge Type

You can also use this option if you have a laser printer that has the appropriate barcode font cartridge and label sheets. The HP part numbers for the cartridge and label stock are listed below.

Font cartridge	Supported Printers
HP 92286W1 "Bar code 3-of-9"	Entire HP LaserJet family
HP C2053A #C06 "Bar codes & More"	Does not support 2686A, PLUS, or 500 PLUS

NOTE: The "W" cartridge listed above is obsolete. It can only be ordered from HP, through their special order line.

Labels stock: label size 2**b**" x 1**d**" 3 across, 8 down on a page
HP part number: HP 92285L

NOTE: Other manufacturers also make label stock, but this is an unusual size.
Refer to the instructions in the section below (page 38) for feeding label stock into the printer.

After selecting the label option, you are reminded to check that the proper cartridge is installed and asked to specify the label position. Because high density stations use few tapes and we don't want to waste label sheets, you can put the labels for several experiments on a single page. You are prompted for the label row number (1 through 8) to start on.

Epson or Epson24 Printer Types

The Epson MX-80 or compatible printer, with graphics option, will print bar codes.

Labels: label size 1 7/16" x 4" on 1 1/2" vertical centers
`Drudg` supports only a single label column.

Be careful not to smudge bar code labels made with the Epson printer. They become fairly smudge-resistant if left to dry for an hour or so before use. Otherwise, handle them carefully until dry.

Label positioning and printer setup is very important. Follow these precautions:

Horizontal - Position so that the left edge of the label (not the backing paper) is at print position 1.

Vertical - Position so that the perforation is at the ridge in the print backing plate, about 3/8" from top of print backing plate.

Ribbon - Ribbon should be loaded according to the instructions on the ribbon cartridge, i.e. it goes behind the little plate immediately in front of the print head.

Paper bail - When printing, the paper bail (the bar with print positions stamped on it) must be in the forward position away from the paper. This will prevent smudging of the labels.

Using Label Stock with Laser Printers

Practice on sheets of paper until you are confident of what you'll get, because the label sheets are fairly expensive.

It is recommended that label sheets be fed manually into the printer. For the Laserjet Series I, set the manual feed button, then feed the sheets from the back when "PF" flashes. The Series I does not register very well with manual feed and so this model printer may not be satisfactory.

For the HP Series II or III, put a label sheet into the manual feed slot and fold down the tray on the back of the machine. These procedures feed the label sheets straight through the printers with no rolling. This is advised so that labels do not inadvertently come unstuck from the sheet and gum up the inside printer mechanisms.

Other notes and cautions about the labels:

Feeding - You can have the label sheets fed from the tray. Leave approximately 50 sheets of your regular copy paper in the paper feed tray. Load up to 10 sheets of labels in the paper feed tray as you would your regular copy paper, *fanning the sheets.* Refer to your machine instructions on whether to place the labels face up or face down.

Storage - Store labels in a cool, temperature controlled place. Very long periods of storage can cause labels to curl and jam in machines.

Exposure - Slight adjustments of exposure control may be necessary on some machines to achieve best quality on labels.

Option 61: Print PostScript label file

This option prints the PostScript temporary file that was generated with option 6 (page 35). You are presented with this option only if the type of label printer is set to `postscript` in the control file.

`Drudg` looks for a file named `DRlab.tmp` in the temporary directory as specified in the control file (see section 2.4, page 3), or if none is specified, in your local directory.

If the temporary file exists, `drudg` will print it using the script specified in the control file following the `labels` key word. If no script was specified, the file is printed using the system command `lpr`. Refer to the discussion under Option 6 (page 35) for more about generating and printing the PostScript file.

After the labels are printed, the temporary file is deleted. If the file still exists when you exit `drudg`, you will be asked whether you want to print the labels. If you want to print them, `drudg` will do so and then delete the file. If you do not want to print them, the file will be deleted.

Option 7: Re-specify stations

This option allows you to go back one step and re-specify the stations you are working on. This means you don't have to re-enter `drudg` in order to work on another station's output. The prompt is identical to the original prompt for a station ID.

Option 8: Get a new schedule file

With this option you can effectively start `drudg` over again and get another schedule file or SNAP file to work on. The prompt is identical to the original prompt for a schedule file name.

Option 9: Change output destination, format

This option lets you specify interactively the output destination, the printer type for listings, and the orientation and font size of the listings. Your choice takes effect in `drudg` for the remainder of your session or until you change it again. Any choices specified in the control file are overridden when you use this option. You can restore the control file defaults for the orientation and font size by specifying the default in response to the prompt. Refer to the discussion about the control file in section 2.4 (page 3).

Each of the output choices available with this option may be specified in the `drudg` control file. If no control file is present, the defaults are used. The output defaults to going to the printer. The default printer type is `LASER`. The default orientation and font size for each type of listing is given in the description of each option in previous sections.

Prompts

The first prompt asks for the output destination. You may specify either the printer or a file:

```
Output destination set to PRINT. Just enter return if you do not wish
to change, else type a file name or PRINT   ?
```

Type **`print`** to direct the output to the printer. To direct output to a file, simply type the file name at the prompt. Note you cannot have an output file named **`print`**. The default destination is **`print`**. If you give a file name, any listings from options 1, 4, or 5 will go to this file.

The second prompt asks for the printer type:

```
Printer type set to LASER.  Just enter return if you do not wish to change,
else type LASER, EPSON, or EPSON24  ?
```

Give the type of printer that you want for the output listings. This choice determines which escape codes are sent to the output device for different fonts or orientation.

The third prompt asks for the output orientation:

```
Output orientation set to DEFAULT.  Just enter return if you do not wish
to change else enter (P)ortrait or (L)andscape or (D)efault  ?
```

If you specify portrait or landscape, this will force the output of any listings to be printed in this orientation. If you specify the default format, then the format in the control file will be used. If no format was specified in the control file, then the optimum format for the type of listing will be used.

The fourth prompt asks for the output font size:

```
Output font size set to DEFAULT.  Just enter return if you do not wish
to change else enter (S)mall, (L)arge, or (D)efault  ?
```

If you specify small or large font, this will force the output of any listings to be printed using this font. If you specify the default, then the font size in the control file will be used. If no default is in the control file, then the default is to use a small font.

If you are using scripts to print the temporary files, then you can control the orientation and font size with appropriate system and printer commands in the scripts. In this case you should select the option that gives the number of lines and length of lines that you want.

Interaction with Control File

Printing listings is accomplished in `drudg` by writing to a temporary file named `DG.tmp` in the directory specified for temporary files and then using a system command to print this file. You can use the control file (section 2.4, page 3) to specify the script or system commands for printing the output, or you can use the defaults.

To specify a script or system commands, put the script file name or the commands themselves into the control file. In the `$print` section use the key words `portrait` or `landscape` followed by the script name or the commands themselves. The format of the line is:

`portrait` *name_of_script_file*
`landscape` *name_of_script_file*

or

`portrait` *list_of_system_commands*
`landscape` *list_of_system_commands*

If you do specify printer scripts then `drudg` will use those to print the output and no other commands (such as escape codes) will be used. In this case the temporary file written by `drudg` will be a plain ASCII file, ready to be handled by your scripts. When sending the file to be printed, `drudg` invokes either the script for portrait output or the one for landscape output depending on the settings

of the `option`*n* keywords in the control file. Refer to the descriptions of option 1 (page 16), option 4 (page 31), and option 5 (page 32).

If you did not specify scripts for listings in the control file, `drudg` inserts into the temporary file the necessary escape codes that will put the printer into portrait or landscape mode and other codes to set the font size. In this case the temporary file will have escape codes embedded in it and `drudg` will print the file with the system command

```
recode latin1:ibmpc file | lpr
```

where *file* is the name of the temporary file.

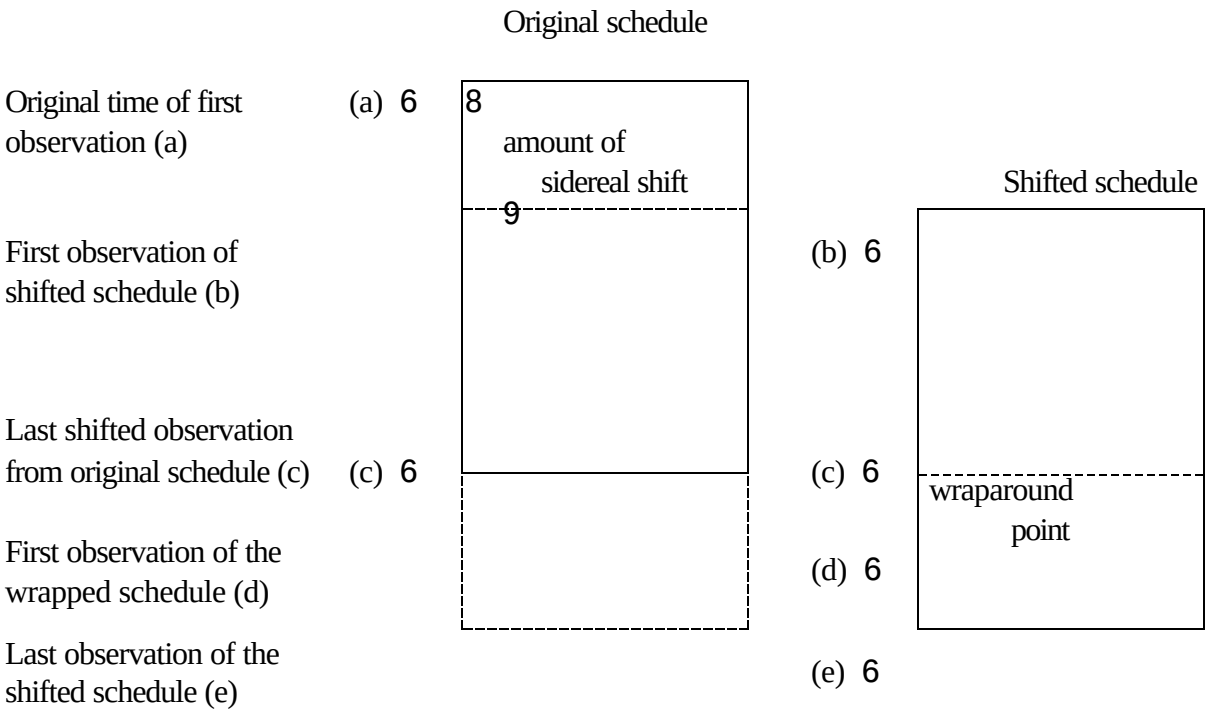
If you did not specify a script for labels in the control file, `drudg` uses the command `lpr` *file*. Refer to the description of option 6 (page 35) and 61 (page 40) for more information about labels.

Option 10: Shift the .SKD file

This option produces a modified schedule file that can be used at a time other than that originally scheduled. The observation schedule may be shifted to an earlier or later date, and may start at any of the shifted times in the new schedule. The necessary time shift is applied to allow for the difference between sidereal and universal time, assuring that sources will be at exactly the same sky location as they were when originally scheduled.

Caution: Do not use this option unless you have been specifically instructed to do so by the scheduling center or the principal investigator.

Below is a sample dialogue, followed by an explanation of the program's screen output. Immediately below is a graphical depiction of a schedule in its original and shifted forms. The points illustrated on the graph are described in the text that follows.



As drudg begins the shifting, you are first prompted for the output file name:

```
SHIFTING xasia1.skd
ENTER NAME OF OUTPUT FILE (:: TO QUIT): xasia2.skd
```

The output name must be different than that of the original, and if a file already exists with the name you enter, you are given the option of having it purged or entering a new name.

Next you are asked for the target date for the new schedule, which should be in the format y,m,d, i.e., the year, month and day, separated by commas. The year may be either two or four digits (e.g., 84 or 1984).

```
Enter target date (y,m,d) (0,0,0 to quit): 91,7,18
```

The target start time is requested next. drudg will find the shifted observation whose time is closest to, but later than, the requested start time.

```
Enter target start time (h,m,s) (-1,0,0 to quit): 16,0,0
```

Finally, you are asked how long the new schedule should be. drudg will re-shift and append pieces of the shifted schedule until the length is right.

```
How long do you want the shifted schedule to be
(enter number of hours, 0 to quit): 24
```

Now drudg starts reading the schedule and prints out various information messages. Following is an explanation of what is happening as it goes along.

```
Tape change time =  420.  Modular start time =   10.  Prepass time = 600.
```

drudg reads the $PARAM section of the schedule file to find these times. They are used if the schedule has to be wrapped around to achieve the length you asked for.

```
Writing out schedule file up to $SKED section.
```

First all of the lines in the file up to the start of the scheduled observations are written into the new file.

```
Original time of first observation  91 105-10:20:00
```

The original sample schedule was 24 hours long, starting at 10:20 UT. This is point (a) in the picture above.

```
Sidereal shift is   94 days, and   -6h   -9m   -40s
```

drudg displays the number of days the schedule will be shifted and the sidereal shift. A shift of -6 hours means the first observation in the original schedule would be shifted to 4 UT. This is the "amount of sidereal shift" shown in the picture.

```
First observation of the shifted schedule   91 199-16:01:50
```

This is the first shifted observation found that was later than the requested start time of 16:00. This is point (b) in the picture.

```
Last shifted observation from original schedule   91 200-04:08:10
```

The end of the original schedule was at 10 UT, and after shifting by about -6 hours, the last observation is at 4 UT, at point (c) in the picture. The end of the scheduled observations has been reached, but due to the shifting we still don't have 24 hours in the new schedule yet. This point in the new schedule is called the "wraparound" point, between (c) and (d) in the picture.

```
Going back to beginning of schedule to get  12 more hours.
```

drudg returns to the beginning of the schedule and shifts it by an additional day to produce additional observations at the required time. Point (a) in the picture is shifted by one more day to produce the next observation after point (c).

```
Sidereal shift of wrapped schedule is    95 days, and   -6h   -13m   -30s
```

The schedule is shifted by an additional day, resulting in observation times being shifted by an additional 4 minutes.

```
First observation of the wrapped schedule  91 200-04:33:30
```

drudg found the next possible observation, after shifting the original schedule by an additional day. It allowed enough time for all stations to change tapes, including spinning down the remaining tape on the old reel. The observation goes at point (d) in the picture.

```
Last observation of the shifted schedule  91 200-16:34:10
```

When the desired length of schedule is reached, drudg stops adding observations. This is at point (e) in the picture.

```
Copying rest of schedule file beyond $SKED section.
```

The remainder of the original schedule is copied into the new file.

```
SHIFTED FILE shift.skd CREATED
```

Shift Calculations

The size of the time shift to be applied to the original schedule is obtained by the formula:

Shift = .002737909 x (original Julian date - target Julian date)

This gives the shift in units of days, which is then converted into days, hours, minutes and seconds, rounded to the nearest MOD seconds, where MOD is assumed to be 10 for SNAP files, and is found in the MODULAR parameter in the $PARAM section of schedule files. For the wrapped around portion of a new schedule, one or more additional days worth of shift is included in order to avoid overlap.

If the original schedule is longer than 24 hours, when we wrap around from end to beginning, the shifted start time of the first tape turns out to be earlier than the time the last observation was to be finished. To prevent such overlap, drudg determines at the time of the wrap-around the earliest feasible time for the next observation to start. Then any observations scheduled to start before that time are simply omitted from the new schedule.

In the case of a SNAP schedule (option 11), the next allowable time is obtained by simply adding seven minutes to the time when the last tape stopped. In the case of a schedule file (option 10), the next allowable time is calculated as follows:

```
T(next) = T(last) + DURATION + CHANGE + SPIN TIME
```

where T(last) is the start time of the last observation, DURATION is the duration of the last observation scheduled, CHANGE is the sum of the parameters from the $PARAM section of the schedule file that give the tape changing and prepass times, and:

```
SPIN TIME = (FEET + DIR x DURATION x SPEED - 160)/22.5 + 10
```

where FEET is the position of the tape at the start of the last observation, DIR is the direction of the tape during that observation (1=forward,-1=reverse), SPEED is the tape speed during the observation.

Option 11: Shift the .SNP file

With this option, `drudg` shifts a SNAP file. It is recommended that you use option 10 (page 46) to shift the original schedule file and then make a new SNAP file from the shifted schedule. Shifting the schedule is more reliable because `drudg` has all the information it needs and you are guaranteed that each station will end up with the same schedule for making their SNAP files.

> **Caution: Do not use this option unless you have been specifically instructed to do so by the scheduling center or the principal investigator.**

`drudg` does not have all of the information available that it would with the schedule file and so some assumptions are made about modularity, tape change time, setup time, etc.

This option has not been revised to be as automatic as the schedule shift option (option 10).

The program may ask for the year that the original schedule was made for (if that information is not available in the SNAP file itself - new schedules have the year in the file). If :: is entered, execution of the program is terminated.

You are informed of the size of the shift which `drudg` will apply to the times in the original schedule, and `drudg` will list the adjusted starting time for each tape pass in the schedule.

```
Enter target date (y,m,d)(:: to quit): 1988,2,29
Sidereal Shift is    9d and    0h  -35m  -20s
SHIFTED PASS START TIMES
# ddd-hh:mm:ss  D # ddd-hh:mm:ss  D # ddd-hh:mm:ss  D # ddd-hh:mm:ss  D
1  60-03:17:40  R 2 60-3:48:50  F 3 60-4:08:40  R 4 60-4:46:10  F
5  60-05:09:50  R 6 60-5:32:30  F 7 60-5:56:10  F 8 60-6:27:20  R
.....
```

You will then be asked to enter the number of the pass you wish to begin your schedule with, so that you have some control over the time of day that the new schedule is to begin. Finally, the program will produce the new schedule, and when finished, will give you a completion message. The SNAP file will automatically be wrapped around and shifted again if necessary.

```
Enter # of pass to start with (0 to quit): 35
```

```
Shifted file /SCHED/SKTEST.SNP created
```

Options 12–16: Make procedures (.PRC)

All of the SNAP procedures needed to set up your station's VLBI equipment can be generated from information in the schedule file.

Output File Name

A Field System procedure file named

scheduleID.prc

is created in the directory specified in the control file (see section 2.4, page 3) in the $proc section. If no directory is specified the local directory is used. In this file name, *schedule* is the schedule name and *ID* is the two-character station ID (lower case).

This option creates a variable number of procedures depending on the number and type of observing modes. drudg generates a full set of procedures for each observing mode, including setup for each subpass, BBC/VC setup, IF distributor setup, track format and tape format. Different commands and different procedures are generated for each observing mode depending on the type of equipment at your station.

Any procedure definitions found in the schedule file section $PROCEDURES will also be written into the procedure file.

Procedure Naming Scheme

The procedures are named by drudg so that each is unique. The parts of the names are taken from the various elements of the observing modes, as shown in the list below.

ff	two-letter frequency code or observing mode code
p	subpass number (for Mark III modes) or letter (for VLBA/Mark IV modes)
c	channel bandwidth, one of 1, 2, 4, 8, d (16 MHz or "d"ouble), h (0.5 MHz or "h"alf), q (0.25 MHz or "q"uarter), e (0.125 MHz or "e"ighth).
r	sample rate, normally twice the channel bandwidth.

m	one-letter code for the mode, `A`–`E` for Mark III, `V` for VLBA non-data-replacement modes, `M` for Mark IV data-replacement modes or non-standard Mark III modes (lower sideband LOs or racks with only 8 BBCs).
nn	fan-out, either `14`, `12`, `11`, or null if none.
b	barrel roll, either `16:1`, `8:1`, or null if none.

These codes are also used in the description of the SNAP commands within the procedures, shown in the following subsections. Also, please refer to the complete list of commands generated for the SNAP file with option 3 (page 25).

The procedure names are formed according to the following scheme:

ffcmnnp	subpass setup procedure
`vc`*ffc*	video converter procedure
`bbc`*ffc*	baseband converter procedure
`ifd`*ff*	IFD procedure
`tapefrm`*ffmnn*	tape format procedure
`trkfrm`*ffmnnp*	track format procedure

One complete set of procedures, including all the subpasses, is generated for each observing mode in the schedule file.

proc_library Procedure

A procedure named `proc_library` is produced as the first procedure in the library. This procedure contains a single comment that lists the experiment name, the station name, and the station two-letter code. This procedure serves to identify the file for anyone examining it. A sample procedure has the following contents:

```
define proc_library
"  ca036   GILCREEK  A  Gc
enddef
```

Subpass Setup Procedure

For each frequency code and for each subpass within the code, a procedure with the following contents is created:

`define` *ffcmp* (procedure to set up the equipment for this subpass)

`tapefrm`*ffmnn*	(set up tape format, not used for S2 recorders)
`pass=$,same`	(position the heads, not used for S2 recorders)
`trkfrm`*ffmnnp*	(set up track assignments, not used for standard Mark III modes or for S2 recorders)
`tracks=`*list_of_tracks*	(tracks to be recorded this pass, not used for standard Mark III modes or for S2 recorders)
`rec_mode=`*m*`,$,`*b*	(set up recording mode, for S2 recorders only)
`user_info=1,field,,auto`	
`user_info=2,field,,auto`	
`data_valid=off`	
	(set up commands for S2 recorders only)
`form=`*m*`,`*r*`,`*nn*`,`*b*	(set up formatter, not used for S2 recorders)
`form=reset`	(reset formatter, Mark III rack only)
`!*`	(reference time for formatter setup, VLBA racks only)
`bit_density=`*value*	(bit density value, only for VLBA recorders)
`systracks=`	(default system tracks command, VLBA recorders only)
`bbc`*ffc*	(BBC setup, VLBA racks only)
`vc`*ffc*	(video converter setup, Mark III or Mark IV racks only)
`ifd`*ff*	(IF distributor set-up)
`tape=low`	(turn on low tape sensor, not for S2 recorders)
`enable=`*tracks*	(enable tracks for this subpass, not for S2 recorders)
`!*+8s`	(wait for formatter setup to complete, VLBA racks only)
`repro=byp,`*trka*`,`*trkb*	(set up two tracks for reproduce from the enabled list, not for S2 recorders)
`enddef`	

After `drudg` generates the setup procedure for each pass, it then makes all of the procedures that are called by the setup procedures. The resulting procedure library will then be complete and consistent for the experiment.

VC/BBC Pocedure

For each frequency code, a procedure with the video converter or BBC frequencies is created. Frequencies are computed as the absolute value of the difference between a station's total L.O. and the sky frequency. Information in the `$CODES` section of the schedule file is used. It is recommended that you check the LO frequencies and IF channel names by looking at the IF distributor procedure.

`define vc`*ffc*	(video converter setup procedure, Mark III and Mark IV racks)
`vc01=`*freq*`,`*c*	(first video converter)

```
... etc.
!+1s                    (wait a second for the internal oscillators to lock)
vc01=alarm              (turn off alarms)
... etc.
enddef

define bbcffc           (BBC setup procedure, VLBA racks)
bbc01=freq,c,if,c       (first BBC setup, if is the IF channel name, one of A, B, C, or D.)
... etc.
enddef
```

`drudg` checks that the LO frequencies have been specified for your station and issues a warning if they were not in the schedule file. It also checks whether the IF channel names are consistent with the type of equipment at your station and issues a warning message if they are not. For example, if you requested procedures for a VLBA rack, but `drudg` finds an IF channel name of "1N", it would say this is inconsistent. `drudg` also verifies that the calculated video converter frequencies are in the range 0 to 500 MHz or BBC frequencies within the range 500 to 1000 MHz and prints a warning if they are not.

IFD Procedure

For each frequency code, a procedure is created with the command to set the IF distributor and the LO and patching information. This allows automatic setting of IF inputs and attenuation if switching between frequency codes will be done.

The procedure for Mark III and Mark IV racks has these commands:

```
define ifdff            (IF distributor converter setup procedure, Mark III and Mark
                         IV racks)
ifd=atn1,atn2,inp1,inp2 (setup IF1 and IF2, inp1 and inp2 are either nor or alt, or
                         null if not used)
if3=atn3,out,1,1        (IF3 setup, for the case where it is not used)
if3=atn3,in,2,2         (IF3 setup, for the case where it is used in the schedule)
lo=freq1,freq2,freq3    (LO frequencies for channels 1, 2, and 3, null if not used)
patch=lo1,nns ...etc.   (list of patching for each video converter in use. nn is the number
                         of the video converter, s is either h or l depending on whether the
                         video converter frequency is above (high) or below (low) 220
                         MHz.
patch=lo2, ...          (list of patching for second LO, if in use)
```

`patch=lo3,`*nn*`h` (list of patching for third LO, if in use, always set to high, although high and low have no meaning for IF3)

`enddef`

Attenuator settings are not known at the time `drudg` is run, so the IFD command contains illegal values to remind the operators to insert the proper values in the field.

There is no way in the schedule files produced by `PC-SCHED` or `sked` to specify whether a station has an IF3 module or not, therefore the IF3 command is always issued for Mark III and Mark IV stations, regardless of whether IF3 is being used in the schedule. This insures that the module is set up properly. It is assumed that if a station has an IF3 module that it is wired into the system and must be set up. The VEX file from `sched` should contain a complete description of the station equipment and in this case `drudg` will only issue an IF3 command if the schedule file indicates that the station has one.

The procedure for VLBA racks has these commands:

`define ifd`*ff* (IF distributor converter setup procedure, VLBA racks)
`ifdab=0,0,nor,nor` (setup IFA and IFB)
`ifdcd=0,0,nor,nor` (setup IFc and IFD)
`lo=`*freqa*`,`*freqb*`,`*freqc*`,`*freqd* (LO frequencies for channels A, B, C, and D, null if not used)

`enddef`

Tape Format Procedure

The tape format procedure lists the offset head positions that are used in this observing mode.

`define tapefrm`*ffmnn* (one tape format procedure for each mode)
`tapeform=`*pass,offset,* ...etc. (list of pass numbers and offsets)
`enddef`

Track Format Procedure

The track format procedure lists each assigned track and the signal to be recorded on it. there is a separate track format procedure for each subpass of the observing mode.

`define trkfrm`*ffmnnp* (one track format procedure for each subpass)

`trackform=`*track*`,`*nnsi*`,` ... etc. (for each *track* recorded in this subpass, *nn* is the video converter or BBC number, *s* is either `u` for the USB signal or `l` for the LSB signal, and *i* is either `s` for the sign bit or `m` for the magnitue bit)

`enddef`

If any channel has a lower sideband LO, i.e. if the sky frequency is lower than the LO frequency, then upper and lower sideband is reversed in this command.

Tape Load and Unload Procedures

Tape loading and unloading procedures are generated that are specific to the type of recorder at the station. These procedures may be called from the standard procedures `ready` and `unlod`.

```
define unloader                 (tape unloading for  S2 recorders)
rec_mode=16x8-1,0
rec=eject
enddef

define unloader                 (tape unloading for Mark III, Mark IV or VLBA
                                 recorder)
!+5s
enable=
tape=off
rec=unload                      (VLBA recorders only)
st=rev,135,off                  (Mark III/IV recorders only)
enddef

define loader                   (tape loading for S2 recorder)
rw
!+20s
et
!+10s
tape=reset

define loader                   (tape loading for Mark III, Mark IV, and VLBA recorders)
rec=load                        (VLBA recorders only)
!+10s                           (VLBA recorders only)
tape=low,reset                  (VLBA recorders only)
st=for,135,off
```

```
!+11s
et
!+3s
enddef
```